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Özel, FM, Davies, HC, Ernst, CS & Nieuwenhuis, P

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How to Strategically Position European SMEs as part of an Electric Vehicle Technology Value Chain

Abstract

European policy aims for a clean transport sector for improving the competitiveness of the automotive industry. By supporting small and medium enterprise (SME) development, European Union (EU) can achieve both economic growth and emission reduction targets. It is expected that there will be changes in the established relationships within the automotive supply chain in moving from internal combustion engine (ICE) to electric vehicles (EVs), and SMEs that are more capable of developing those technologies might have a role in the possible EV based automotive value chain re-shaping. The "European Network on Electric Vehicles and Transferring Expertise" (ENEVATE) partnership conducted a series of interviews with SMEs throughout North-West Europe to investigate support areas that SMEs need to have to play a role in this possible EV based automotive value chain re-shaping. It was found that SMEs needed more support for protecting technology, establishing relationships and funding investments.

Keywords: European Financial Instruments and SMEs; Electric Vehicle Sector in Europe; Future Automotive Supply Chain; SME Support

1. Introduction

The electrification of the vehicle drivetrain offers a viable solution for the sustainability requirements of the transport sector and to achieve emission reduction targets. It is expected that there will be change in the established relationships within the automotive supply chain in moving from internal combustion engine to electric vehicles (EVs) (Özel et al., 2013), and small and medium enterprises (SMEs) that are more capable of developing those technologies (Pilkington et al., 2002, Wesseling et al., 2014, Özel et al., 2013) might have a role in the possible EV based automotive value chain re-shaping. Maximising SME engagement and benefit from the transition to EV is very significant owing to their potential in triggering economic development and innovation via the exploitation of emerging EV business opportunities.

Europe 2020 is a 10-year strategy proposed by the European Commission on 3 March 2010 for development of the economy of the European Union (EU). It aims at smart, sustainable and inclusive growth" with greater coordination of national and European policy (Commission, 2010a). It follows the Lisbon Strategy for the period 2000 and 2010. According to Europe 2020 strategy, EU targets to reduce CO_2 emissions and grow SMEs. Yet, there are motivators (Pilkington et al., 2002, Wesseling et al., 2014, Özel et al., 2013) and barriers (Marin et al., 2014) for SME involvement that are either preventing or stimulating growth and innovation.

In this paper, we propose that EU can achieve both economic growth and emission reduction targets by supporting small and medium enterprise (SME) development. Hence, we investigate the support areas SMEs need to have a role in the possible EV based automotive

value chain re-shaping by conducting in-depth and semi-structured interviews with SMEs. Interview study is then linked with EU`s financial instruments to discriminate policy and delivery of EU`s financial instruments for SMEs on the basis of their perception on motivators and barriers for EV business. In so doing we recognize that improving the link between policy and delivery for SMEs might stimulate the EV technology and business in Europe.

2. EU Policy

The road transport sector is one of Europe's fastest growing sectors in terms of CO_2 emissions; with a growth of 36% over the last 18 years (Pasaoglu et al., 2012). In response, and also to comply with its commitments under the Kyoto Protocol, the European Union (EU) has taken a number of actions to try and significantly reduce dependence on imported oil and cut carbon emissions in transport. EU aims to reduce overall CO_2 emissions by 20% by 2020 and 80% by 2050 (2010). For transport, this involves a 60% reduction target for 2050, compared to 1990 levels (2011c). To enshrine this commitment, a legislative framework was introduced in order to provide drivers for the EU automotive sector towards a set of specific CO_2 reduction targets, thus in April 2009, the EU adopted Regulation 443/2009/EC which established a CO_2 emission target of 130 g/km for the average of new cars sold by 2015. Perhaps the most attractive option on this pathway towards low-emission vehicles is electric propulsion (Hacker et al., 2009) which is a technology alternative to internal combustion engine.

In addition to cutting carbon emissions, EU also aims economic growth. In EU, there are more than 20 million SMEs representing 99% of businesses. SMEs are the true back-bone of the European economy and a key driver for economic growth, innovation, employment and social integration in addition to their crucial role in innovation and research and development (R&D). Thus, the European Commission aims growth by promoting successful entrepreneurship and improving the business environment for SME with policies designed for assisting SMEs at all stages of development. The Small Business Act for Europe embodies the EU's commitment to SMEs and entrepreneurship. Disruptive EV technologies (Bakker et al., 2012, Pilkington et al., 2002, Hardman et al., 2013, Pilkington and Dyerson, 2004) create many opportunities for SMEs since they are more capable of developing those technologies (Pilkington et al., 2002, Wesseling et al., 2014, Özel et al., 2013). With this capability, they might also have a role in the possible EV based automotive value chain re-shaping.

EU supports co-operation, innovation and growth with funding instruments. During 2007-2013 period, EU financially supported research, technical development and innovation with three key funding instruments: FP7, Competitiveness and Innovation Framework Programme (CIP) and Structural Funds. Another instrument called European Institute of Innovation and Technology (EIT) programme was also adopted in 2010. For supporting clean transport research, European Green Cars initiative (EGVI PPP) which is a contractual public-private partnership dedicated to delivering green vehicles and mobility system solutions in Europe was established in 2009 under FP7 (Commission, 2009). EGVI PPP aimed at accelerating research, development and demonstration of technologies allowing the efficient use of clean

energies in road transport with R&D grants, The European Clean Transport Facility (ECTF) loans under European Investment Bank (EIB) loans and demand side measures & public procurement. On 28 April 2010, the European Commission also presented a strategy, under the framework of the Europe 2020 strategy, for clean and energy efficient vehicles ("Green vehicles: a European strategy") aimed at encouraging the development and market uptake of these vehicles (Commission, 2010b). Throughout FP7, SMEs were actively encouraged to get involved especially under the Cooperation programme and Joint Technology Initiatives.

In January 2014, EU launched the Horizon 2020 framework programme (2014-2020) to support research, technical development and innovation. With this framework programme, "key funding instruments" except than structural funds (FP7, CIP and EIT) has been integrated, and "smart, green and integrated transport" has been set as one of the main societal challenges the commission will address. EGVI PPP has also been improved and started implementing focused research programmes for the energy efficiency of vehicles and alternative powertrains under Horizon 2020 programme (EGVI, 2013). The program has simplified most of the rules for participation and has brought new opportunities for SMEs with SME Instrument program. The new SME program provides full-cycle business innovation support with simpler procedures and more financial support (Commission, 2014).

INTERREG IVB North-West Europe (NWE) Programme which is a financial instrument of the European Union's Cohesion Policy (under structural funds) funds projects supporting transnational cooperation. The aim is to find innovative ways to make the most of territorial assets and tackle shared problems of Member States, regions and other authorities (INTERREG, 2013). In 2012, INTERREG IVB NWE has funded the "European Network on Electric Vehicles and Transferring Expertise" (ENEVATE) partnership (ENEVATE, 2012) in order to facilitate and accelerate the introduction of e-mobility in NWE region. The ENEVATE partnership involving partners from NWE (figure 1) is an initiative of European Automotive Strategy Network, which is a platform for European Automotive regions, clusters, companies and institutes, aiming at identifying opportunities for SME competitiveness and collaboration, and encourages SMEs to use support. ENEVATE also provides input to policy makers (EU and national) and, thus, improves link between policy and delivery. As part of its remit, The ENEVATE partnership has investigated support areas SMEs need to have a role in the possible EV based automotive value chain re-shaping in NWE. This has been done by conducting in-depth and semi-structured interviews with SMEs throughout NWE. SME responses are then linked with FP7 and Horizon 2020.

3. Methodology

The methodology was based on the seven stages of an interview investigation (Kvale, 1996). The first stage was to determine the environment that SMEs operate in (stage 1 – thematizing). Then, in-depth and semi-structured interviews were selected and interview questions were prepared in order to answer the research question (stage 2 – designing). Next, the interviews were conducted based on the interview guide and on a one-to-one basis with individuals representing SMEs from the emerging EV sector (stage 3 – interviewing). Post interview, the recorded interviews were transcribed for analysis (stage 4 – transcribing).

Qualitative analysis of the interview transcripts was then undertaken to seek patterns, themes, and meanings explaining SME answers (stage 5 – analysing). The results of the qualitative analysis were provided in tabular form with exemplars from the interview transcripts and key themes. The results were compared with FP7 and Horizon 2020 (stage 6 – verifying). The results of the study were then communicated with reports (stage 7 – reporting).

4. Thematizing

In moving from internal combustion engine (ICE) to EV it is expected that there will be change in the established relationships within the automotive supply chain. SMEs might have a role in the possible EV based automotive value chain re-shaping as below:

The current ICE vehicle production network is a global "producer-driven value chain" with "regionalization" (Bailey et al., 2010) or "regional integration" (Sturgeon et al., 2008) strategies. In this global network, whereas "systems integrators" (or tier 0.5suppliers) and first tier suppliers that are closely linked to OEMs have significant roles via "modularization" (Bailey et al., 2010), second tier suppliers work for systems integrators and sometimes deliver components directly to OEMs. However, the SMEs are located in the last step of this – often described as a pyramid shaped – architecture and they have only marginal roles by supplying the second tier companies mainly via subcontracting arrangements (Frigant, 2011). SMEs still have direct access to OEMs in the case of simple components, or in some cases specific high technology components for which the SME owns unique IPR. The conventional view of supplier 'tiering' in this pyramid shape is therefore an over-simplification, although direct access to OEMs is limited resulting in marginal roles for SMEs. Thus, current automotive supply chain, which saw major consolidation of the supply base with the developments over the past twenty years or so, exists increasingly on a 'one:few' relationships where SMEs have limited roles (Niewenhuis and Wells, 2003).

With the production of EVs, vehicle components and suppliers are changing owing to the EVs` different composition. In the transition from ICE to EV there would be a loss of value-add associated with the internal combustion engine and transmission as well as additional components which correlate with a design optimized on an ICE. There would also be additional value-add tied to the EV component costs, which at this time are the exclusive preserve of the supplier. Although new types of components are required, no existing mass production supply chain exists for those components. Thus, EV sector currently relies on 'one:many' relationships where technology and process satellites provide the necessary product and expertise to the automobile manufacturer, or OEM. This is very different from the present mainstream automotive sector (figure 2). It is considered that the nascent EV sector will similarly evolve from the present 'one:many' relationships to a 'one:few' relationships that mirrors existing automotive industry practice and SMEs might have roles in the possible EV based automotive value chain re-shaping (Özel et al., 2013) with right support. For example, Tesla Motors which has been supported by the United States` Advanced Technology Vehicles Manufacturing (ATVM) program has reached a market capitalization of $22 billion (General Motors` market capitalization is approximately $52 billion) in a very short time (Gross, 2013). Thus, understanding SMEs and supporting them

will be valuable for facilitating and accelerating the development of EV technology and business in NWE.

5. Designing and Interviewing

The type of interview used involved an in-depth and semi-structured (that is qualitative / informal conversational / guided) approach. In-depth interviewing seeks to achieve the same level of knowledge and understanding possessed by the respondent and to understand personal experiences and perceptions within a contextualized, social framework (Patton, 2002). In-depth interviews are conducted on a one-to-one basis. These interviews typically last from 30 minutes to more than an hour. They attempt to uncover underlying motives, prejudices, or attitudes towards sensitive issues. The goal is to get the deepest possible understanding of the setting being studied. This requires identifying expert participants who can provide information about the particular topic and setting being studied. For example, interviews are arranged with a predetermined number of people from different categories (e.g. by job title or rank). This type of interview was chosen as it was seen as a useful tool for enabling comparison of views of respondents from different backgrounds or if you have different people asking the questions. The first of these was a factor in this investigation.

The selected approach was conducting a number of semi-structured interviews with individuals representing SMEs from the emerging electric vehicle sector. The interviewees were chosen intentionally from the companies which were engaged in electric vehicle related activities with the specific intention of providing different specialties in EV business and a broad geographical coverage across the NWE project area (figure 3). Interview candidates meeting those criteria were identified by using ENEVATE SME database (ENEVATE, 2013). The interviews were conducted based on an interview guide (figure 4). The identification and interviewing process continued until the theoretical saturation (main support areas for accelerating innovation in EV area) was achieved. In terms of interviewed data, the emphasis was on quality rather than on quantity.

6. Transcribing and Analysing

Post interview, the material was prepared for analysis. Qualitative (thematic) analysis of the interview transcripts was then undertaken to seek patterns, themes, and meanings that generate in-depth understanding of the phenomenon of interest. Qualitative analysis is approached as a critical, reflective, and iterative process that cycle between data and an overarching research framework that keeps the big picture in mind. The analysis is inherently a process of interpretation. We should not be afraid to ask questions of the data. These questions can be informed by theory or our own observations, hypotheses or hunches. If the analysis is rigorous and transparent then the data should be able to support or not support these. This is the important part - the data should support or refute our ideas; we should not fit the data into the story we want to tell.

There were two parts to analysing the data. These were as follows:

- "Content analysis" steps: Read transcripts > Highlight quotes and note why they are important > Code quotes according to margin notes.
- "Exploration analysis" steps: Sort quotes into coded groups (themes) > Interpret patterns in quotes > Describe these patterns.

In this context, codes are tags or labels for assigning units of meaning to descriptive or inferential information. Coding is the process of organising the data into "chunks" that are alike, moving from words and sentences to "incidents".

The results of the thematic analysis were provided in tabular form in the appendix. The region is identified and exemplars from the interview transcripts provided. The key themes (taken from the analysis of the interview data in its entirety) are then given.

6.1.Technology

After Schumpeter, innovations have generally been defined as either incremental or radical (Christensen, 1997, Tushman et al., 1997). According to technological paradigms that were proposed in 1982 (Dosi, 1982), while incremental innovations relate to normal technical progress (continuity), radical innovations cause emerging new paradigms (discontinuity). When automotive industry is studied with this phenomenon, which has grown to become the single largest manufacturing sector in the world (Nieuwenhuis et al., 2004, Köhler et al., 2009) and it has been dominated by the internal combustion engine for more than a century (Tanaka, 2011), ICEVs are the incumbents and BEVs are a disruptive technology (Bakker et al., 2012, Pilkington et al., 2002, Hardman et al., 2013, Pilkington and Dyerson, 2004). The contribution of new entrants to technological development is strong in the field of a competence-destroying technology such as BEV technologies especially during an era of ferment (Tushman and Anderson, 1986). Our interview study looked at the significance of the disruptive BEV technologies for the selected group of SMEs. Some exemplars from the interview data are provided below. These exemplars are deliberately chosen to show the themes coming through from the analysis of the interview data.

"We use advanced technologies….. That situation draws a lot of customers to the company"

"The technology was protected by patents but difficult to enforce "

"My plan at this stage is keeping 100% of the patent for myself"

"Our technology is not that protected. We have patents and designs. But, we are too small to protect it. There are paper works and lots of costs associated with it. So, our strategy is bringing the technology to the market faster and makes more innovation"

As presented above, the EV sector was defined as a technology-driven niche market by the interviewed SMEs because the technology was viewed as the primary attraction for encouraging customers (figure 5). Since new entrants boost the technological development of radical innovations by exploiting the novel combinations of related technological fields (Schumpeter, 1934), attracting customers who were interested in high technology products was not a surprise. Yet, SMEs were cautious to exploit EV technologies due to difficulties of

protecting intellectual property. The difficulties were claimed to have arisen from high avoidance costs.

Themes: Customer Base; IP Protection

6.2. Motivation

It has been stated that disruptive technologies create opportunities for new entrants in competence-based studies (Tushman and Anderson, 1986, Utterback and Suarez, 1993) and more recent market-based approach of disruptive innovation study (Christensen, 2006). This is because radical innovations lower entry barriers and open up windows of opportunity for new entrants to enter the market (Tushman and Anderson, 1986, Utterback and Suarez, 1993, Blees et al., 2003, Jovanovic and MacDonald, 1994, Wesseling et al., 2014). All of the historical successful disruptive technologies entered niche markets with ease and received less competition from incumbents than they would in mass markets, and often they received no competition at all. An additional factor making niche markets attractive is that incumbents may not be properly serving them. This means that there already may be a demand for the disruptive technology (Hardman et al., 2013). Our interview study wanted to learn what motivated SMEs to be active in EV sector. Some exemplars from the interview data are provided:

“In 2006, I made research on EV infrastructure because EVs were getting popular. I saw that it is a very interesting sector and there are opportunities for business”

"We wanted to enter a market promising opportunities in future technology “

"When we were involved in vehicle electronics, we have involved with the Japanese companies. With this involvement, the company saw the growing trend of EVs“

As presented above, the EV sector in NWE attracted SMEs since it was a niche market that SMEs can position their existing expertise and product knowledge. The emergence of an EV sector provided opportunities for SMEs to become part of a developing supply chain. SMEs had ability to service new markets and the potential to grow the company (figure 6) with disruptive BEV technologies. There was also a strong belief in the continued growth of the electric vehicle sector and each of the organisations had a strong belief that the market had yet to establish itself fully. This belief is perhaps driven by the nature that transport and access to transport is in demand from European consumers (Ghersi and McDonnell, 2007) which means that there is a big market for the companies if the technology is to change from ICE to EV.

Themes: Market; Growth

6.3. Main Challenges

Identifying main challenges was one of the most significant parts of our study in order to define the main support areas that will stimulate the growth of SMEs for the benefit of NWE. Again, some exemplars from the interview data are provided.

"Big Players don't necessarily allow SMEs to grow. You don't get most of the components, if you don't take a big demand" and "[your involvement is a] political decision of big automotive players and Tier 1 suppliers"

"A lot of big companies see this business some kind of hobby. We have to prove ourselves" and "The customers want to see a working prototype"

"We are poorly supported by the local governments. Government`s policy for SMEs and innovation are relatively bad"

The dominant theme, as described above, in this case was establishing relationships. Firstly, it was claimed that establishing relationships between the SME (the newcomer) and the established automotive sector was challenging (figure 7). SMEs claimed that the focus of the established player on volume was restrictive. Existing practices were seen as counterproductive to development. This situation was raised especially in Germany owing to the strength of existing automotive supply chain and the issue of breaking into this chain as an independent organisation with a business model outside of the traditional automotive supply chain. Secondly, establishing relationships with customers was also seen as a challenge. Some SMEs claimed that it was necessary to demonstrate working prototypes for convincing the customers and establishing long-term relationships. Lastly, lack of government involvement to take any initiative in favour of accelerating electric mobility was also seen as a challenge for some SMEs. It was clear that technology alone was not sufficient to be able to establish a place in this emerging market and this was very restrictive for SMEs.

Themes: Relationship

6.4.Financing

If an SME exploits a new emerging market then SME requires finance for overcoming challenges. Throughout FP7, SMEs were actively encouraged to get involved especially under the Cooperation programme and Joint Technology Initiatives. A funding rate of 75% for research and development activities of SMEs and a guarantee fund which would cover the financial risks of project participants were offered by FP7 in order to support SMEs (Cordis, 2011). The interview study looked at the approach of the selected group to financing growth and whether or not they use European funding programs. The exemplars are provided below in support of the analysis of the interview data:

"We look at the product, the money we generate from that return to back to the developments and developments grow. That is basically how we fund the developments"

"I have no funding whatsoever directly to my company. So, the only funding that is interesting for me is the subsidies of all my products"

"The projects get through the auto cluster and you have peer-reviewed from experts. It helps getting financed because then you have the experts having validated your project. They don't have the money but they have the networking"

The underlying theme for the SMEs interviewed was that they intended in the short term to fund growth through existing margins gained from the sales of the products (figure 8). Only a few of the SMEs interviewed used European funding programs for financing their projects, often feeling that the system was bureaucratic and the risk that the investment made in pursuing such funding streams was too high given other pressures on the business. One SME stated that there was an auto cluster peer-reviewing the activities and giving some degree of confidence to SMEs in order to go forward looking for other investment and grant opportunities.

Themes: Growth; Grant Availability; Networking

6.5. Business Models

Since 2004, the number of companies producing electric vehicle (EV) models has substantially increased with start-up firms comprising a majority of that growth. The number of start-up firms has increased from 2004–2011 especially from 2006 onwards. It was reported that serving niche markets might be a reason behind the increase of start-up firms in EV market (Sierzchula et al., 2012). Our interview study wanted to understand whether or not SMEs in NWE serve to the niche markets, and what kind of business models they adopt to support their market intake. Some exemplars are provided as below:

“We don’t want to compete in a mass market, it is not our business. We are looking for niche market”

"We want to be taken over by a bigger company where we can have some kind of independency inside the company”

"We are partnering up with the investors to provide funding to grow the company”

“We are absolutely in a niche market. But, because our vehicle is pedal assisted, we are a niche market within the niche”

It was found that SMEs in NWE were serving to niche EV markets as expected and they adopted different business models (figure 9). These ranged from a technology provider that indicated its very existence relied on exploiting niches and it would move onto the next emerging niche as the existing one transitions to the main stream. Others were positioning themselves to either grow in response to market expansion by becoming part of a larger group or partnering up. Nearly all the SMEs interviewed demonstrated a need for strategic partnerships. It was clear that the role of SMEs in the emergent EV sector in NWE was limited by the confidence in the market and the need for resources.

Themes: Market Penetration; Partnerships; Business Takeover

6.6.Manufacturing

After business model decisions were clarified, the question was how SMEs link their business model with their manufacturing base. The interview data disclosed that manufacturing

decisions demonstrate the same trend with the business model decisions. Opinions of some SMEs on their manufacturing decisions are given below:

"Current low demand is dealt with batch production."

"We want to scale up the production and allow low cost companies to manufacture our battery"

"We have built prototypes but we do not manufacture anything. We build prototypes to demonstrate that we are capable of doing everything"

"Although new machinery can support the production by decreasing the cycle time, it is not considered currently because of the financial burdens"

"For our next model, we want to produce 500 a year and we want to assemble it on our own."

Since the demand was low (Özel et al., 2013), adopted approach was small volumes of production which was flexible according to demand (figure 10). Yet, most of those companies either outsourced the non-core competencies or bought them from suppliers (generally partners of SMEs) to manage demand fluctuations and lower risks involved with manufacturing and holding inventory. SMEs also identified a risk on how to move to the next level on business where investment is required but the market potential is uncertain. This resulted in a disconnection between the potential of SMEs to become part of the future EV supply chain based on technology and based on manufacturing capacity.

Themes: Flexibility; Demand; Investments

6.7.Customer Relations

There are a lot of barriers mentioned in the literature to the adoption of EVs such as: unfamiliarity with EVs, range anxiety, unavailability of home charging, public infrastructure, and prices and cost of ownership (Dubin et al., 2011). However, one of the main challenges is also establishing relationships with customers as found in "main challenges" section. The question to SMEs was therefore how they would overcome this challenge. Some exemplars are given below:

"Consumer is the main business unit for our company. We make focused conversion based on the requirements of the customers"

"To keep in touch with our customers, we create newsletter, we offer after sales support, we send e-mails and invite them to the fairs. We give presentations to them."

"We are looking for long term relationships with the customers."

"The benefit of [cluster organisations] is that we know our competitor and our customers, we can discuss with them and share our knowledge. Basically, we cooperate with each other. At the end, we both benefit."

The strategy was clearly as described above valuing networking opportunities and establishing long term relationships with customers (figure 11). Interviewed SMEs had close relations with the customers even after the sale. To establish relationships, cluster organizations (for those that have worked in such forums) were seen as invaluable.

Themes: Relationships; Networking

7. Verifying and Reporting

Verifying relates to the 'reliability' (or how consistent the results are) and 'validity' (or whether an interview study investigates what is intended to be investigated) of the data. The interview structure was deliberately chosen to place the research team in the position of SMEs so that they learnt from SMEs as opposed to confirm pre-held ideas and concepts. The results are also compared with FP7 and Horizon 2020

SMEs are very significant for EV sector since they are more capable of developing disruptive electric vehicle technologies (Pilkington et al., 2002, Wesseling et al., 2014, Özel et al., 2013). Our research found that although EV market in NWE was a technology driven niche market, SMEs were cautious to exploit EV technologies due to difficulties of protecting intellectual property. Horizon 2020 brings opportunities for SMEs with IP SME corner. It is an official IP service initiative of the European Commission providing free-of-charge, first-line advice and information on intellectual property rights (Helpdesk, 2014). It is a very beneficial service to inform SMEs about managing intellectual property rights. Yet, more specific technology protection measures for SMEs need to be considered. Such measures can significantly increase patent filings in the region and increase the development, diffusion and use of EV technologies in the supply chain.

SMEs need financial resources for development and commercialisation of EV technologies. Our research found that SMEs were funded through existing margins gained from the sales of the products. This was restrictive as sale revenues were used both to fund existing business and to make new investments. Small amount of funding left for new investments were rarely sufficient to fund up-scaling of production and development to the levels needed to feed into mass production processes at OEMs. EU financially supported clean transport research, technical development and innovation with EGVI PPP grants and ECTF loans under FP7. For SMEs, specific funding opportunities especially with the Cooperation programme and Joint Technology Initiatives were also offered with FP7. Yet, only a few of the SMEs interviewed used these programs often feeling that the system was bureaucratic and the risk that the investment made in pursuing such funding streams was too high given other pressures on the business. With the launch of Horizon 2020, most of the rules for participation, dissemination, evaluation and implementation were simplified. Simpler rules for grants were introduced and time to grant was reduced by 100 days. Fewer, better targeted controls and audits were also

introduced. Moreover, SME instrument program was launched. The instrument provides full-cycle business innovation support from the stage of business idea conception and planning (phase I- €50,000 grant) over business plan execution and demonstration (phase II - €500,000 to 2.5 million grants) to commercialisation (phase III). Participants of SME instrument program are also able to call on business innovation coaching for the duration of their project in order to enhance the company's innovation capacity and foster their project's long-term commercial sustainability. Another opportunity for SMEs under Horizon 2020 is National Contact Points. They provide information and guidance to SMEs wishing to participate in EU research and offer personalized support in the proposer's own language (Commission, 2014). All these support can now be accessed by using a single IT platform called "Participant Portal". Yet, SMEs need to be informed about these opportunities to join these projects.

Interviewed SMEs demonstrated a need for strategic partnerships to both build a capable supply chain and share risks. However, it was very challenging to contract with larger organisations. Thus, while some SMEs wanted to exploit niches and move to the next emerging niche when the existing niche EV market transitions to the main stream, others wanted to position themselves to either grow in response to market expansion by becoming part of a larger group or partnering up. Establishing relationships are very significant to support SMEs to step up to the next level in the possible EV based supply chain. Although FP7 supported establishing relationships by prioritizing collaborative projects, it was not found attractive by SMEs owing to the perception that procedures were difficult. For both FP7 and Horizon 2020, three independent legal entities from three different Member States or Associated States are required to join collaborative projects (Cordis, 2011). With Horizon 2020, most of the procedures are simplified and various partner search services such as National Contact Points, Enterprise Europe Network and CORDIS Partner Search are offered. With Enterprise Europe Network, SMEs that want to apply for Horizon 2020 funding can find business partners and they can get information about EU legislation and regional funding opportunities (Commission, 2014). Clusters, forums, networks, exhibitions and demonstrations are also good places for knowledge-sharing and establishing relationships. Especially, the protection and networking offered by cluster organisations are thought to be beneficial. For example, a mobility cluster in France presented opportunities for SMEs by pre-evaluating their ideas. Projects that successfully passed the peer-review process were awarded with a label helping to finance 45% of the project. Even if the auto cluster did not finance the projects directly, they helped SMEs to be financed by providing a network and offering collaboration. In that context, auto clusters and projects offering SME-OEM cooperation should be encouraged.

8. Conclusions

In this paper, we proposed that EU can achieve both economic growth and emission reduction targets by supporting SME development. Hence, this research investigated support areas SMEs need to have a role in the possible EV based automotive value chain re-shaping in NWE. It did this by conducting a number of in-depth and semi structured interviews with

SMEs. SME responses were then linked with FP7 and Horizon 2020 programs to improve the link between policy and delivery. It was found that:

- The role of SMEs in the emergent EV sector in NWE was limited by the confidence in the market and the need for resources. There was also a disconnection between the potential of SMEs to become part of the future EV supply chain based on technology and based on manufacturing capacity.
- Profits from small volumes of specialist products were rarely sufficient to fund up-scaling of production and development to the levels needed to feed into mass production processes at OEMs.
- SMEs needed strategic partnerships to both build a capable supply chain and share risks. However, it was very challenging to contract with larger organisations.
- SMEs were cautious to exploit EV technologies due to difficulties of protecting intellectual property.
- For interviewed SMEs, it was also difficult to engage with FP7 since they needed more support for protecting technology, establishing relationships and funding investments. Such kinds of support might further stimulate SMEs to step up to the next level in the possible EV based supply chain.
- Although Horizon 2020 offers many opportunities for establishing relationships and raising finance for SMEs, they need to be informed about those opportunities. Specific technology protection measures for SMEs are also required.

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Figures

ENEVATE Partners	Country
Campus Automobile Spa-Francorchamps	Belgium
Flemish Institute for Technical Research (VITO)	
Pôle Véhicle du Futur	France
Agiplan GmbH	Germany
Bayern Innovativ GmbH	
Forschungszentrum Jülich ETN	
Inno AG	
Regional management Nordhessen GmbH	
Electricity Supply Board (ESB)	Ireland
AutomotiveNL	Netherlands
Cardiff University	United Kingdom
Future Transport Systems (FTS) Ltd	
European Automotive Strategy Network (EASN)	

Figure 1: ENEVATE Partners

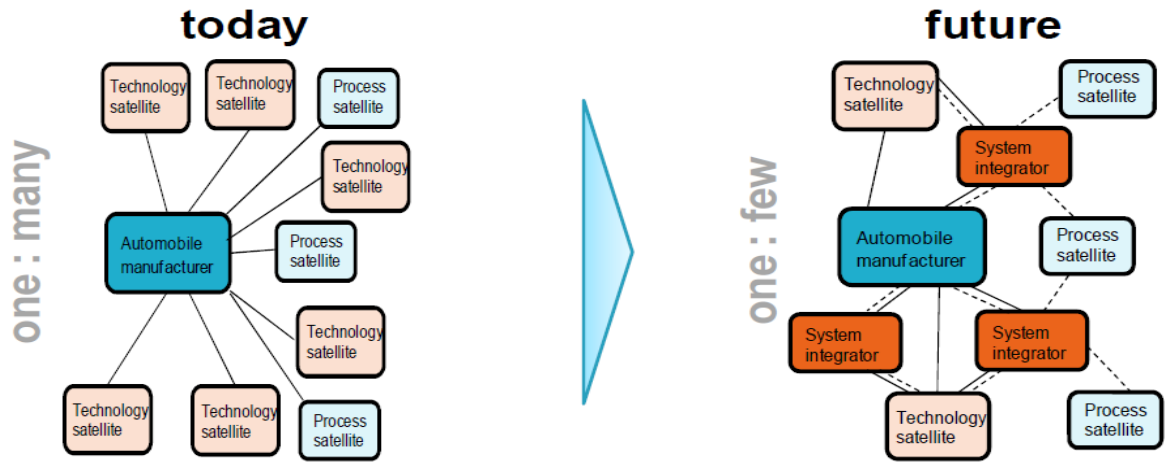

Figure 2: EV Sector of Today and the Future

Country	Company	Specialty	Size
Germany	Company A	Electric Motor	<50
	Company B	Thermal Management System	<50
	Company C	Electric and Hybrid Powertrain Systems	<50
	Company D	EV Manufacturer	<50
France	Company E	Mobility Services	<50
	Company F	Vehicle Electronics	<100
	Company G	Range Extenders	<10
United Kingdom	Company H	Batteries	<50
	Company I	Electric Motor	<50
	Company J	EV - Hybrid Manufacturer	<200
Netherlands	Company K	Prototyping and Engineering Software	<10
	Company L	Power Solutions	<50
	Company M	Vehicle Modifications	<100
Belgium	Company N	Agent of EV Companies	<10
	Company O	Infrastructure and Service	<10

Figure 3: Interviewed SMEs

Area	Questions	Discussion Points
Market	Are you active in the field of coupling between Smart mobility and EVs?	Yes
		No, dont think
		No, will be in a short time
		Other
Manufacturing	How do you deal with current low demand (and why?)	Manufacturing and selling
		Outsourcing
		Other
Strategic	What is your business model (and why)?	Want to sell products or services in the EV market
		Preparing for being taken over by a Tier supplier
		Other
Strategic	What will increase the demand on EVs?	Government Incentives
		Infrastructure Development
		R&D Development
		Other
Strategic	What will be the main problem for mass manufacturing EVs?	High EV adaptation costs (new machinery, certificates..)
		Lack of expertise
		Coordination difficulties and inertial resistance
		Change in the supply chain (suppliers, customers)
		Other
Manufacturing	What`s your plan if 10.000 units are required to produce in a year? (and why?)	We are flexible enough to speed up production volumes 10.000 units in a yea
		Outsource some parts and manufacture others
		Increase the system flexibility and support in-house manufacture
		Other
Strategic	What is your strategic decision for the next 3 and 10 years (and why)?	Develop and produce on your own
		Develop and produce in joint venture (with whom?)
		Develop and produce in strategic alliance (with whom?)
		Sell your ideas know-how patents to others (future opportunities?)
		Other
Market	Which market do you target? (and why?)	Big automotive mass market(passenger cars, E-scooters)
		Fleet market (buses and trucks)
		Niche market (Premium passenger cars)
		Other
Interviewer Name:		
Interviewee Name and Position:		
Company Name and Region:		

Figure 4: Interview Guide

Country	Technology and Innovation Decisions	Themes
GERMANY	"Technology plays a key role for pushing the new products such as bi-directional charger that can be used with the future smart grid applications"	Customer Base
	"We have unique technology that extends the range of vehicles. The technology plays a key role for determining the market position and pushing new products to the market. We believe that the unique technology will help us to earn money even after 12 years"	Customer Base
	"The contracts we sign become our customers intellectual property. If we can patent the technology we develop, we also look for ways to patent it"	IP Protection
	"Our technology is not that protected. We have patents and designs. But, we are too small to protect it. There are paper works and lots of costs associated with it. So, our strategy is bringing the technology to the market faster and makes more innovation"	IP Protection
UK	"Our lighter, easy to manufacture and more eco friendly ceramic battery determines the market position. The technology also drives the company to be active in other markets such as China and India as there are more interest to the company`s technology in these countries"	Customer Base
	"Our innovative motors attract the customers. It allows us to grow without marketing and advertising. We protected the technology with patents but it did not help other companies to steal the technology. After a while, we dropped the legal fight because of high avoidance costs. To avoid the same situation again, the two materials that are used for the motors are known by no one except me"	Customer Base; IP Protection
	"We offer purity of driving. That is why our customers sometimes wait for years to buy a car from us. If we can integrate this with disruptive technology, we could do a quite good job. So, we need to combine the traditional car with modern technologies. We patented our chassis and suspension. Our company name and the shape are registered as trademarks"	Customer Base; IP Protection
NETHERLANDS	"We use advanced technologies for prototyping, manufacturing proto parts, assembly, engineering, building new vehicles and converting conventional combustion engine to a 100% electric drive. I think we built one of the first EVs built in the Netherlands. It was the first electric vehicle and the answer was due to legislation. Although we are an SME, we are running crush tests for the vehicles. That situation attracts lots of customers"	Customer Base
	"Our switch mode power technology allows us to be active in different kinds of applications areas such as audio, video, industrial, medical and automotive. For the e-mobility, charger and inverter designs ensure the optimal balance between functionality, quality and weight for on-board as well as stationary use"	Customer Base
	"We are very innovative. We are the first one in Europe that started with wheelchair accessible vehicles and low floor mini buses. We were also behind the idea of aluminium floor systems which are more flexible. The company won the innovation award at the bus exhibition. We expect to earn more money in the future due to our developments"	Customer Base
BELGIUM	"We are a leading provider of sustainable and easy to use “plugin” solutions for recharging and driving EVs. Our stylish and intelligent on street charging post has achieved design excellence with top finishing quality and is based on state-of-the-art, sustainable, reliable and proven technology"	Customer Base
	"Mostly, my customers are authorities buying EVs. it is because they have targets and they have clean up directs"	Customer Base
FRANCE	"I am eager to trial innovative vehicles. I want to run hydrogen cars or vehicles with other alternative fuels in the future. We also want to run "intermediate" vehicles such as bicycles, pedelecs, mopeds, motorbikes, quadricycles (e.g. Twizy), with or without electric engines as they are cheaper mobility alternatives for the customers"	Customer Base
	"We are in the technology business. This situation creates high pressure on the company to be agile and to constantly offer cutting-edge solutions for the industry"	Customer Base
	"My unique, innovative, simple and convenient solution helps me for marketing and contacting with bigger companies. My plan at this stage is keeping 100% of the patent for myself "	Customer Base; IP Protection

Figure 5: Technology and Innovation Decisions

Country	Initial Motivation	Themes
GERMANY	"With the crisis, all product range went down. In order to keep the business up, we started developing our own e-power train"	Growth
	"Developing an environmentally friendly refrigerant. Since the refrigerant was proven to be more efficient, we wanted to develop an air conditioning system based on the refrigerant carbondioxyde for the automotive sector"	Market
	"We wanted to enter a market promising opportunities in future technology"	Market
	In 1973, there was an oil crisis. Because of the crisis, the oil prices increased. In that time, I thought that would be a market for electric vehicles. Electric Vehicles offer opportunities.	Market
UK	"The company is a start up from a zero base with no commercial products. We wanted to achieve a substantial commercial position in the battery industry with innovative know-how"	Market
	"The company was created after the invention of a very successful and innovative electric motor"	Market
	"We understood the market is going there and carbon emissions are big problems for the entire world. Basically, we wanted to build a lightweight car by using the latest drivetrain technology and we wanted it to be fairly efficient"	Market
NETHERLANDS	"I wanted to fill a gap in the market OEMs left by converting cars"	Market
	"The company wanted to fill a gap in the market on know-how on making cost efficient, robust, efficient power conversion applications"	Market
	"The transportation sector is changing and that is resulting in the integration of public transportation sector and taxi companies. After the integration, the change will be on cleaner technologies which we identify as an opportunity"	Market
BELGIUM	"In 2006, I made research on EV infrastructure because EVs were getting popular. I saw that it is a very interesting sector and there are opportunities for business"	Market
	"I got my very first training on EVs in the army, strangely. After working in different places for a couple of years, I wanted to look at the horizons of electric mobility because of the opportunities"	Market
FRANCE	"We believe that offering innovative solutions (technology and service innovation) and meeting specific, local mobility requirements of customers will attract more customers for the company"	Growth
	"When we were involved in vehicle electronics, we have involved with the Japanese companies. With this involvement, the company saw the growing trend of EVs. It was all about finding the customers of customers in EV. And, progressively, we have been pulled down to EV routes supplying equipment to companies in the manufacturing batteries"	Growth
	"I wanted to solve both the price and range issues of EVs by not increasing the total cost of ownership. I wanted to produce range extenders that is rented and attached to back of the car only when needed"	Market

Figure 6: Initial Motivations of SMEs

Country	Market Challenges	Themes
GERMANY	"Big Players don't allow SMEs to grow. You don't get most of the components, if you don't take a big demand"	Relationships
	"Political decision of big automotive players and Tier 1 suppliers for not using carbondioxyde as a refrigerant cause high pressure on the green manufacturers. You don't get most of the components, if you don't offer a big demand"	Relationships
	"We are poorly supported by the local governments. German government`s policy for SMEs and innovation are relatively bad"	Government Involvement
	"There is pressure from OEMs because they want to keep their market. Finance also challenges us"	Relationships; Raising Finance
UK	"Because of the little interest of UK government to lead/acid batteries, we are looking for new markets in developing countries (China and India) to raise finance"	Government Involvement; Raising Finance
	"Financial challenges limit our investments"	Raising Finance
	"Different markets require different products. For example, we are having problems with safety issues because US market is more safety concerned than Europe"	Standardization
NETHERLANDS	"A lot of big companies see this business some kind of hobby. Especially in this kind of field (if you are converting cars) they mainly see you as a hobbyist. So, we have to prove ourselves"	Relationships
	"The customers want to see a working prototype. Financing challenges our growth"	Relationships; Raising Finance
	"People want to see a working prototype. We cannot deliver the built cars to Asia or Australia because of high logistics costs. Because the customer of the public transportation is cities or governments and the concessions normally require 8-10 years, the most current concessions are based still mainly on diesel or natural gas resulting on low number of EVs on the roads."	Relationships; Raising Finance; Government Involvement
BELGIUM	"In this business, most of the initiatives are coming from private sector. I mean, sun is not shining very brightly in anywhere. But, government needs to have a right vision. In terms of infrastructure, there are de facto standards. But, France has type 3 standards"	Government Involvement; Standardization
	"Sometimes, the government is making wrong choices. My business is in very big need of cash because I buy the vehicles, physically buy them, and sell them "	Government Involvement; Raising Finance
FRANCE	"Financial and technical incentives such as free car parking, helping the individuals to install charging stations at home, and allowing the green drivers to drive in bus lanes are not adequate"	Government Involvement
	"Financing challenges the company`s growth. Contacting with big players is difficult"	Raising Finance; Relationships
	"It is difficult to getting grants from regional public funders. Contacting with big players outside of France is challenging "	Government Involvement; Relationships

Figure 7: Market Challenges

Country	Raising Finance	Themes
GERMANY	"We invest without any funds from the government. We invest completely with our money but we are looking for partners for buying bigger amounts and investing more money into the business."	Grant Availability, Networking
	"The company is funding itself with the margins gained from the sales of the products. Incentives always help but there is not a substantial business case behind it. It just gives an early start. Mostly, the governments of states or the federal government in Germany say that these are successful projects we have supported. So, that gives us an additional insight.We are looking for partners in order to buy bigger amounts"	Grant Availability, Networking
	"The weakest point of Germany`s funding strategies is funding the innovation. If we were designing components, our funding from the local government could be relatively easier. We are poorly supported by the local governments because German government`s policy for SMEs and innovation are relatively bad"	Grant Availability
	"There are two owners of the company. We are investing for our company. But, we are discussing for having external investors for our company. Right now, we are in a national project. It is a local funding project from Hessen region. We are only taking advantage of regional level funding currently because it requires time consuming procedures, a lot of paperwork. It is attractive but it is hard for us"	Growth; Grant Availability
UK	"We are looking for partners to finance the company and increase the production. Actually, we want to be active in China and India because the UK government`s interest to lead/acid batteries is not enough"	Growth; Grant Availability
	"To roll the company, we built partnerships with investors. Financing challenges our intention to invest in new machineries which can decrease the production time of motors significantly. I do not think applying to government incentives because they are difficult and they take lots of time"	Growth; Grant Availability
	"The funding is coming from internally. We use 1/3 of our profits for investing. My personal opinion is that the government cannot run the business. But, little help is appreciated. The government support is not bad. Still, it can be improved a little bit"	Growth; Grant Availability
NETHERLANDS	"The company is funding itself. We are looking for a partner who can take care of the production line. I am struggling everyday how to survive in the market. We need support from government or from European community to go ahead. It is just support from the back it is not to survive. But if you apply for such a project you need at least 10 companies. To enter as an SME to these programs, only as an SME, it is not possible. I think that markets like in Germany are investing much more for SMEs"	Networking; Grant Availability
	"We look at the product, the money we generate from that return to back to the developments and developments grow. That is basically how we fund the developments. Of course, if you find a funding program that fits and helps you, it would be good to do that. But, I don't believe in any of those funding programs anyway. We want to have partners"	Grant Availability; Networking
	"The company is funding itself with its developments. Funding programs are also explored to accelerate the current projects. We want to be integrated with tenders, government officials, our partners and customers to survive. We cannot deliver the built cars to Asia or Australia because of high logistics costs"	Grant Availability; Networking
BELGIUM	"I am financing the company. There are no subsidies made available. Growth rate depends on external parameters which you cannot control such as government involvement and how supportive they are. In Belgium, there is no initiative whatsoever from the federal government. I cannot also rely on to European Projects to grow my company. You need to hire someone to analyse those kinds of projects. They have been set up for bigger companies"	Grant Availability; Growth
	"I try to keep my overhead costs as little as possible because my business needs lots of cash to buy the vehicles and sell them to the cities and municipalities. So, there are terrible cash flow peaks. There are projects funded entirely by the network providers. But, I have no funding whatsoever coming directly to my company. The only funding that is interesting for me is the subsidies of all my products"	Grant Availability; Networking
FRANCE	"All the funding is coming from internally generated revenue. We are looking for partners. More financial and non-financial incentives are required to increase the demand on EVs"	Grant Availability; Networking
	"We are looking at having external partner because we have come to the limits of what we can reasonably do. To fund the growth of the company, we just plug out everything back into the company. We are the shareholders. If the company is going to carry on, the amount of capital you need just carries on increasing. But, we are on the limits. With an outside partner, we can have that sort of rampart"	Grant Availability; Growth
	"The company tries to finance the projects with the grants from regional public funders. I am looking for partners in order to build the tenders and set up the rental network. Because the funding process of regional public funders is very detailed, onerous and slows down the commercialization process, only people who initially have the money and the contacts can go through"	Grant Availability; Networking

Figure 8: Raising Finance

Country	Business Model Decisions	Themes
GERMANY	"We launched Germany's first mass-produced EV. We don't want to come in a mass market because when OEMs come with products, it will be very difficult for us to sell more cars. We are looking for niche market and partnerships especially for buying bigger amounts and using the technologies in different applications"	Market Penetration; Partnerships
	"Our core competency is developing, manufacturing and distributing refrigeration machines. We want to be more active at EV business as long as it continues to be a niche market. If the demand increases a lot, we will move to another niche. We are also looking for partnerships in order to buy bigger amounts and using the technologies in different applications"	Market Penetration; Partnerships
	"We are an engineering outfit for vehicle integration of alternative vehicles. We are an internationally linked company with many partners. We want to be small enough for flexibility and not to have financial burdens. But, we also want to be big enough to demonstrate that we are ready for big projects with OEMs"	Market Penetration; Partnerships
	"We produce a human-electric hybrid vehicle to carry two passengers and cargo. Until now, we produced 1000 vehicles. We are absolutely in a niche market. Because our vehicle is pedal assisted, we are in a niche market within the niche. Still, it is necessary to have your own market since we are competing against Renault and Volkswagen by creating our own market"	Market Penetration
UK	"We develop lead/acid batteries for different applications such as e-bikes, scooters, motorcycles, hybrid and electric vehicles. We want to enter China and India market in a short time. In these markets, we look for partners to sell our plate (conductive ceramic) to increase the profit rate"	Market Penetration; Partnerships
	"We develop electric motors for the industry and supply to the cross broad spectrum of the EV Market. We also convert 2,3 and 4 wheeled vehicles, boats and trains. We are partnering up with the investors to finance the company. We want to stay in the EV Market, explore new opportunities there and grow with the market"	Market Penetration; Partnerships
	"It is a family run business. We produced 640 cars in 2007. We have good dealer network worldwide. Our aim is building a strong sales network in the world. Until now, we sold 30.000 cars in the world and we want to hold spares and service them without facing any problem. With a new EV we want to produce, It will be a new niche for us"	Market Penetration; Partnerships
NETHERLANDS	"We develop and construct prototypes of new vehicle concepts, EVs or special vehicles. We make focused conversion based on the requirements of the customers. We are moving towards to a change and being more active in engineering software for interfaces. We want to be taken over by a bigger company where we can have some kind of independency inside the company. We want to stay in the niche market and grow with it"	Business Takeover; Market Penetration; Partnerships
	"The company designs and manufactures products and solutions for a broad range of markets, such as chargers and AC inverters. We are willing to work for bigger companies as a sub-contractor. We are also looking for businesses with bigger companies and OEMs. Lack of making business with these kinds of companies will result in looking for new niche markets"	Market Penetration; Partnerships
	"We develop vehicles adaptations based on the standard vehicles. We are also specialized in the development, testing and construction of vehicle modifications. We aim to be integrated with tenders, government officials, our partners and customers to survive in the market"	Partnerships; Networking
BELGIUM	"We are a a leading European service provider in electric mobility. We offer the most appropriate charging infrastructure for the individuals and businesses. We also offer services and support for our customers. We won the European greenfleet awards and green business award"	Market Penetration
	"I am an Belgian agent of a company. I offer a few brands. 90% of my work is on the small city trucks. Mostly, my customers are authorities buying EVs. it is because they have targets and they have clean up directs. I am working with larger organizations and associations to roll out the electric mobility"	Market Penetration; Partnerships
FRANCE	"We are a global mobility service operator offering a panel of transport solutions on our own or in conjunction with other organisations. We provide mobility services including car-sharing services with EVs. We work both with local authorities and private businesses"	Market Penetration; Partnerships
	"We are a French subsidiary of a small European group of companies. We are involved in the electronics area. We have been supplying equipment to companies involved in manufacturing batteries. We also supply production equipments to electronic manufacturers. We are looking for partners and want to grow with the niche market"	Market Penetration; Partnerships
	"The company is just created with a purpose of building range extenders that is rented and attached to the back of the car only when needed. I want to either sell the patents and charge for per tender or offer subscription to the rental network in our car dealership in order to allow the car maker to sell their cars. I managed to access some of the top people in the EV industry in France. If I cannot find partners in Europe, I will try the Chinese and Indian Partners"	Market Penetration; Partnerships

Figure 9: Business Model Decisions

Country	Manufacturing Decisions	Themes
GERMANY	"The demand is low. We manufacture cars and outsource powertrain. If the demand increases a lot, we can increase the flexibility with automation. I would go into a bigger amount for battery packs or charger. I would produce higher quantities (10000-15000) if there is a market I see for longer period. If I see 1 year peak demand and 1 year low demand then I don't. But, I do not want to invest in new assembly lines or facilities"	Demand; Flexibility; Investments; Supply Chain
	"Current low demand is dealt with manufacturing some parts and buying compressors. We are a middle-sized company. We are not able to manufacture all the components needed. Buying and outsourcing also lowers the risks for the business. System flexibility is low "	Demand; Flexibility; Supply Chain
	"We have built prototypes but we do not manufacture anything. We build prototypes to demonstrate that we are capable of doing everything. If a customer comes and tells us, he needs 300 components within a year or two, we will do it. But, we outsource it. We do not want to invest in money on that. We would like to build a capable supply chain with partners rather than investing money for manufacturing purposes"	Demand; Investments; Supply Chain
	"In 2002, we took over the production. Our next models will be higher volume series. For our next model, we want to produce 500 a year and we want to assemble it on our own. One further model will be more cost optimized and specific product. For these products, we will radically increase the manufacturing output and come to mass manufacturing. We are 12 people. So, we cannot produce everything in-house. We have tools for components. Our suppliers produce them and send the components to us. Then, we just assemble them"	Demand; Flexibility; Investments; Supply Chain
UK	"Current low demand is dealt with batch production. Whole battery is produced and sold. However, we want to scale up the production and allow Chinese companies to manufacture our battery"	Demand; Investments; Supply Chain
	"The demand is low and we produce in batches. Although offering 3 kinds of motors and 15 different options, we use same line, same castings (3 castings types) and same material for the production and modify the finished products to meet the demand. Producing the motors with hand increases the production time (up to 7 hours for a motor). New machinery can support the production. It can decrease the cycle time up to 5 hours. But, I do not want to invest that much money"	Demand; Flexibility; Investments
	"We buy the chassis from USA. All the cars are assembled by hand here. Wood frames are also built here in the factory. Production output is approximately 800 cars a year. We work quite well with BMW. They are manufacturing engines for us. We are very flexible. We have a platform that can adopt itself. That is why we think we can fit an EV to our production as well"	Demand; Flexibility; Supply Chain
NETHERLANDS	"We are mainly producing proto parts and being more active with our services. We are looking for a partner who can take care of the production line"	Service; Supply Chain
	"What we mainly do is that we hire the hands to manufacture it. All the practical technical product documentation: sort of recipe, how to make a product...All those things come from my company. It means that we are taking care of everything, except than manufacturing. So, we sub-contract the manufacturing to a company in Indonesia and other places and we deliver the products ourselves. The demand is medium"	Supply Chain; Demand
	"Because of seasonal demands we need to be very flexible resulting in growing and decreasing continuously. We can start the production anywhere in the world within 6-12 months because of our know-how and previous experiences. We produce nothing in-house. The parts that are sub-assembled by the partners are assembled in-house and delivered to the customers. If we get orders, we can get loose but if there are not big orders, we will remain the same"	Demand; Flexibility; Supply Chain; Investments
BELGIUM	We offer charging infrastructure, services and support for our customers. So, we do not manufacture anything.	Service
	I am an agent for an international company. I buy the vehicles and sell them to the customers. I do the service. I do the transportation of the vehicle and I give the basic training for all the users"	Supply Chain; Service
FRANCE	"Because we are in a service business, we do not manufacture anything"	Service
	"We manufacture nothing. We distribute, buy and resell. However, the products we supply require programming, installation and training"	Supply Chain; Service
	"Small-scale batch production is adopted for manufacturing the tenders. Components such as engine, electric machine, wheels and suspension will be purchased from the partners and the assembly of those components will be subcontracted as they are fairly standard components. If the demand becomes higher, production can be increased by outsourcing the manufacturing of some components"	Supply Chain; Flexibility

Figure 10: Manufacturing Decisions

Country	Customer Relations	Themes
GERMANY	"Consumer is the main business unit for the company. We want to design, manufacture and deliver products in close cooperation with our customers. "	Relationships
	"Consumer is the main business unit for our company"	Relationships
	"Our customers are exclusively business: tier 1 suppliers and OEMs. We do not serve to private customers at all. It is because they cannot afford the service we are providing. It is also the service we provide such as local safety traffic boards are totally irrelevant for private customers. They do not bother"	Relationships
	"In most cases, our customers are private people with business backgrounds. Mainly, customers find us. We also go to the fairs and contact with people there. To keep in touch with our customers, we create newsletter, we offer after sales support, we send e-mails and invite them to the fairs"	Relationships
UK	"Our company wants to design, manufacture and deliver products in close cooperation with the customers"	Customer focused
	"Whenever the petrol prices increase, the more customers are drawn to the market. We don't use marketing. People know me from my customers"	Relationships
	"Customer relations are very important for us. We start communicating from the very beginning. The waiting list for a car is approximately one to two years, although it has been as high as ten years in the past"	Relationships
NETHERLANDS	"Consumer is the main business unit for our company. The user is always looking at the cost. We understood what the customer wants and then we made focused conversion based on the requirements of the customer"	Relationships
	" We are looking for long term relationships with the customers. The benefit of forums is that we know our competitor and our customers, we can discuss with them and share our knowledge. Basically, cooperating with each other. At the end, we both benefit"	Relationships; Networking
	"The customer of the public transportation is cities or governments. The total cost of ownership is being more important for customer choices. We are very much busy with safety regulations, explaining staff, giving differences, giving a to do list because people are not sure with EVs"	Relationships
BELGIUM	"Customer satisfaction is very important for us. We do not just build infrastructure, we also offer services. To support our customers, we offer EV information helpdesk, management platform and EV consultancy"	Relationships
	"I am not only making a good sale but I am also offering a good service. I created enough confidence with my customers. Some of them travels quite a lot to buy from me and only from me"	Relationships
FRANCE	"The company's strategy is basically linked to address people's mobility needs. We try to draw more customers and compete with large transport service operators by offering technology and service innovation and meeting specific, local mobility requirements with a high level of customer service"	Relationships
	"The company grows owing to the professionalization and consolidation processes and by responding the customer requirements. That situation creates a lot of customers for us even if the customers are always changing and makes the company more efficient and agile. I have heard about databases that 900 names in it. I am hoping that databases those 900 names in it has got basic ecosystem in which we can work. That is why I came to this sort of event."	Relationships; Networking
	"My project minimises the people`s risk perception and satisfies the customer by dealing with both range and cost issues. So, I draw more customers into the market. I contacted with large guys because my ID is simple, innovative and it solves a really serious issue"	Networking

Figure 11: Customer Relations